Pam 634.904 : (*423)

Pam 634.904 : (*423) WILTON

Canada

Department of Northern Affairs and National Resources

Forestry Branch

FOREST RESEARCH DIVISION

OCT 6 1961
LIBRARY
BOREAL INSTITUTE

THE FORESTS OF THE SANDWICH BAY AREA, LABRADOR

by

W. C. Wilton

No part of the report may be
published or quoted without
prior consent in writing from
the Director, Forestry Branch

Ottawa

September, 1959

Mimeo, 59-10

POLAR
PAM
4846
POLARPAM

CONTENTS

Page

INTRODUCTION 1

PHYSIOGRAPHIC DESCRIPTION 1

    Geographic Position 1

    Geological-topographic and Surface Soil Conditions . . . 1

    Climate 2

STUDY METHODS 2

    Field Work 2

    Office Compilation 3

THE FOREST, A GENERAL DESCRIPTION 4

THE PRINCIPAL FOREST TYPES 4

REFERENCES 24

FIGURES 1 to 3

APPENDICES

I. List of Common and Scientific Names of Forest Flora

II. Supplementary Tables

III. Maps of the Area
   1. Sandwich Bay Area
   2. Lower Paradise River

THE FORESTS OF THE SANDWICH BAY AREA, LABRADOR

by

W. C. Wilton*

(Project NF-19)

INTRODUCTION

Project NF-19 is a continuing study which is being carried out in order to obtain a familiarity with the forests of Labrador. The 1956 work was conducted in the Grand Lake and Northwestern Lake Melville area which, although it is on tidewater, is somewhat remote from the exposed east coast. The present study was carried out in the lower Paradise River watershed in Sandwich Bay where the forests are considered to be more representative of those of Labrador's coast than those covered in the 1956 study.

During the field season a total of 12 forest areas was subjected to detailed investigation. The ecological descriptions and mensurational summaries of these areas are given in this report.

The 1957 field work was greatly handicapped by transportation difficulties. Air transport was not available and rapids in the Paradise River rendered the waterway unnavigable except in the extreme lower part of the watershed. As a result the forest sampling extended only eight miles upstream and the farthest reconnaissance point was somewhat less than 15 miles above the river mouth. It is possible that different forest conditions may prevail farther inland and therefore this report should not be considered as representative of the entire Paradise River watershed.

PHYSIOGRAPHIC DESCRIPTION

Geographic Position

Sampling was confined within a block between latitude 53°22' and 53°28' north and longitude 57°15' and 57°26' west. This area is located at the southern end of Sandwich Bay and is approximately 25 miles inland from the main Labrador coastline.

The Paradise River flows into Sandwich Bay from a southwest direction. Tidewater extends up this river for about three miles and from there on the river contains numerous rapids.

Geological-topographic and Surface Soil Conditions

The physiography of the Lower Paradise Watershed is shaped by granite and granitoid gneiss bedrock formations (Christie, 1951). The topography of the area consists of medium to steeply sloping hills which, at varying distances from the present course of the river, merge into a rolling plateau at about 500 to 700 feet above sea level. From this plateau several ranges of hills arise.

---

*Forestry Officer, Forestry Branch, Newfoundland District Office, St. John's, Nfld.

The area was heavily glaciated, the effects of which are particularly apparent on many of the recent burns. However, only a small portion of the land is so stripped of mineral soil that it cannot support tree growth and many of the hillsides are covered with a deep, fertile till. Fluvial deposits are scarce except in the immediate vicinity of the river course; here they consist nearly always of coarse sand of varied petrographic origin, rarely grading into silts and clays. Biotite and muscovite are omnipresent in both the glacial and fluvial deposits. The clear-cut distinction between waterlain and till soils which was so evident in the Lake Melville area is not so obvious at Sandwich Bay. This, however, is to be expected since the latter area is more exposed to oceanic influences, and all lake and river deposits would be carried away by tidal scouring and wave action during early post glacial submergence.

Climate

The nearest meteorological station is at Cartwright which is situated at the entrance to Sandwich Bay and very near the outer Labrador coast. Although the Paradise River area is somewhat sheltered from the open Atlantic, and thus might be expected to have a more favourable climate than Cartwright, the two locations are not sufficiently distant from each other to cause a very appreciable climatic difference.

The climatic summary, obtained from the Meteorological Division, Department of Transport (1954), is as follows:

Evenly Distributed Mean Monthly Temperatures (°F)
for Cartwright, Labrador
(elevation 34 ft. above sea level)

Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
6	8	16	27	37	47	56	54	48	38	28	16

The annual rainfall, which is evenly distributed throughout all months of the year, is 40 inches. Thunder storms of short duration develop rapidly and pass over just as rapidly on most sunny afternoons in July and August. This is a phenomenon which was noted also in the Lake Melville area.

STUDY METHODS

Field Work

A five-man field party spent about six weeks in the field investigating the forest conditions prevalent on the Lower Paradise River. During this period 12 areas were sampled. Sampling areas were located first on aerial photographs and then checked on the ground for suitability. Only areas having a distinctly uniform vegetative type were selected for sampling.

The data collected for each area were as follows:

(1) Land form description.

(2) General forest description.

(3) Detailed measurement of ten one-tenth acre plots.

(4) Stem analysis of from two to five dominant trees.

(5) Detailed soil descriptions down to unchanged parent material from one or more soil pits depending upon the uniformity of the sampling area.

The data collected for each plot were as follows:

(1) Origin of stand, disturbance since origin, slope aspect, and topographic position.

(2) Diameter tally of all commercial tree species by one-inch diameter classes.

(3) Diameter, height, age, and crown class of three trees of the dominant species located mechanically.

(4) Amount and species of reproduction on 10 mechanically located milacre quadrats.

(5) List of lesser vegetation by abundance.

(6) Organic soil profile descriptions.

Plots were laid out in a "herringbone" pattern. The method was to establish short cruise lines at two-chain intervals running out at right angles from both sides of a baseline. The plots were placed at three-chain intervals along these cruise lines where possible but could be of varying distances in order to keep within a type boundary.

Each plot and subsequently each sampling area was classed as being either good, medium, or poor site on the basis of forest groups. The soil type, species composition, growth rate, history, lesser vegetation and drainage were all taken into account in this initial site classification.

Office Compilation

The office compilation, which consisted of sorting, grouping, and compiling the field data followed essentially the same format as the 1956 work. On the basis of tree cover and lesser vegetation the forest areas were broken down into recognizable forest types.

Following the procedure developed in the 1957 work, the height-age measurements for sample plots were used to prepare a site index on the basis of three site types. This index was used to check and substantiate the field classification.

Diameter height curves were prepared for softwood species by site classes. Tables constructed from the curves were used in conjunction with taper tables found in Dominion Forest Service "Form Class Volume Tables" (1948), to develop volume tables by species, site and form classes.

Volume compilations were made first on an individual plot basis, then combined for sample areas.

Further growth rate was predicted on the basis of average annual radial growth for the past ten years. The radial growth was applied to each present diameter class to estimate the future diameter ten years hence. Future stand volumes were then compiled for the projected diameters from the volume tables.

The growth of even-aged stands was expressed for both current annual increment and mean annual increment. Net current annual increment is one-tenth the difference less mortality between the stand volume in 1957 and the projected 1967 volume. Mortality was considered to be one-tenth the volume of trees which were estimated to have died within the ten-year period. The growth of virgin stands was expressed as gross current annual increment. This is the amount which could be harvested annually if the stands were managed on a selection basis.

THE FOREST, A GENERAL DESCRIPTION

The entire Labrador Peninsula lies within the boreal forest region and has a vegetation dominated mainly by coniferous species. The Sandwich Bay area, according to Halliday (1937) (revised map 1957), lies within the (B.12) forest section with a dominant tree cover consisting of various associations of black spruce, white spruce, balsam fir, larch, and white birch. These are essentially the same associations as those found in the Lake Melville area (Section B.12), although owing to the closer proximity to the bleak coast, the growing conditions and consequent productivity of the Sandwich Bay area are usually poorer.

Fire has been the dominant factor in shaping the forest pattern in the Sandwich Bay area, but, possibly because of a fairly high rainfall, forest fires have not been as widespread as in the main Labrador hinterland. Black spruce stands of fire origin are in the majority but many of the older fire stands are now overmature and show a high percentage of other species, particularly of balsam fir.

The lower Paradise River watershed lies close to areas of habitation; the village of Paradise has been in existence for about 200 years, and consequently cutting disturbances are frequent. Such disturbances result invariably in conversions to a balsam fir stand. However, in relation to the entire area, these second-growth stands are of minor importance.

THE PRINCIPAL FOREST TYPES

The forest site and type classification followed the same general principles as those used in the Lake Melville survey. An attempt was made to correlate the forest types of the two areas, and while in most cases this attempt was successful, discrepancies do occur.

The entire range of the Lake Melville forest types was not recognized at Sandwich Bay. This could indicate an ecological difference in the forests of the two regions but most likely it is simply a matter of insufficient sampling in the latter area. Conversely, several of the sampled areas at Sandwich Bay were not related to any previously recognized type. This condition seems to be the result of poor typing as these areas have all the appearance of being transition zones. The following table shows the amount of sampling in the different forest types of the two regions. The sampling frequency does not necessarily signify the relative abundance of these types.

TABLE I. SAMPLING FREQUENCY, FOREST TYPES.

Forest Types	Site Class	Sampled Areas Lake Melville	 Sandwich Bay
Black spruce/Lichen fire	III	F	D,I
Black spruce/Feathermoss undisturbed	II	D,H,L,S	-
Black spruce-balsam fir/Feathermoss fire	II	A,B,G	-
Fir-spruce-birch/rich herb undisturbed	I	E,N,O,P,T	A,G
Black spruce-birch/Cornus fire	I	I,M	C
White birch/Cornus fire	I	C	-
Black spruce-balsam fir/Sphagnum undisturbed	II	K,R	B,F
Black spruce/Ledum undisturbed	III	J	E
Transition zone		Q	H,K,L

Both tree heights and form class at Sandwich Bay are considerably lower than those at Lake Melville; consequently there is a tendency for Lake Melville forest types to have a higher volume than similar types at Sandwich Bay, although number of stems per acre and basal area per acre can be similar. These tendencies are illustrated by Figures 1, 2, and 3, which also show the species composition of the various types.

Area A

Type: Fir-Spruce-Birch/Rich Herb

Site Class: I

Age-class: All-aged

Area A is located on the south side of the Paradise River approximately one-half mile southeast of the village of Paradise. It is situated along the mid-slope of a ridge with a southern aspect at an elevation of about 300 feet above sea level. The soil is a rich sandy loam which extends down to a considerable depth. The drainage is unobstructed and soil moisture conditions are optimum for tree growth.

A representative soil profile is as follows:

Horizon	Thickness (Inches)	Description
A_0	6	Dark brown partially decomposed organic material.
A_2	5	Light grey silty sand.
B_2	24+	Red-brown sandy loam with some rock fragments.

This is an all-aged stand composed mainly of balsam fir with some white birch, black spruce and white spruce. The birch and spruce may have ages exceeding 200 years, while the balsam fir rarely exceed 100 years. This is a clear indication that the fir comes in at maturity of a fire-type stand. Balsam fir and black spruce attain 14 inches in diameter at breast height while white spruce occasionally grow much larger. The heights of all species range up to 75 feet.

Regeneration is abundant. TABLE 2 shows that 97 percent of the quadrats are stocked, mostly to balsam fir.

TABLE II. AREA A*, REPRODUCTION IN PERCENT STOCKING OF MILACRE QUADRATS (Basis - 100 quadrats)

Balsam fir	91
White spruce	1
White spruce and balsam fir	3
Black spruce and balsam fir	2
Unstocked	3
	100

*See map 2.

The vegetation of the area is indicative of the good site; both in its richness in species and in its luxuriant growth. Some of the more outstanding species are: Solidago macrophylla, Clintonia borealis, Cornus candensis, Maianthemum canadense, Lycopodium spp., and Trientalis borealis. Alnus rugosa and Viburnum edule occasionally form small patches in stand openings.

This forest type is encountered frequently on rich moist or well-drained till slopes. It does not have the high volume found in the Lake Melville area but is still a good pulpwood and small saw timber stand. While the following stand table shows only 745 stems per acre, which would indicate an understocked stand, most of these trees are merchantable.

TABLE III. STAND TABLE, NUMBER OF TREES PER ACRE BY SPECIES AND THREE-INCH DIAMETER CLASSES.

Diameter Class in Inches	Black Spruce	Balsam Fir	White Spruce	White Birch	Poplar	Total
1 - 3	20	221	-	3	-	244
4 - 6	10	125	-9	34	4	182
7 - 9	15	111	12	67	3	208
10 +	7	45	7	51	1	111
Total	52	502	28	155	8	745

This area has an average softwood volume of 24.7 cords per acre and a gross annual increment of 60 cubic feet.

Area B

Type: Black Spruce-Balsam Fir/Sphagnum

Site Class: II

Age-class: All-aged

This area is located about a quarter mile south of a point on the shoreline where the waters of Paradise River meet the tidewater of Paradise Inlet. It is a flat, lowlying area formed by fluvial deposition along the Paradise River. The soil is mainly stone-free, fine to coarse sand with some silt. It is strongly suspected that the sands are underlain by clays.

The following soil profile is the only one of the area available:

Horizon	Thickness in Inches	Description
A_0	10	Black, partially decomposed organic material, wet.
A_2	2	Grey, silty sand.
B_2	4	Dark red-brown, cemented sand, hardpan.
C	20+	Coarse sand with pockets of silty sand and silt.

This is an all-aged black spruce-balsam fir stand with individual tree ages reaching 300 years. The growth rate is slow and individual trees rarely exceed a diameter of 10 inches or a height of 50 feet.

The regeneration survey shows 97 percent stocking (TABLE 4). Practically all the black spruce originated from layering whereas the other species came mainly from seed.

TABLE IV. REPRODUCTION IN PERCENT STOCKING OF MILACRE QUADRATS.

(Basis - 100 quadrats)

Balsam fir	5
Black spruce	58
Black spruce and balsam fir	33
Balsam fir and larch	1
Unstocked	3
Total	100

The minor vegetation is characteristic of a poorly drained site. Sphagnum moss is the main component with lesser amounts of Calliergon Schreberi, and other mosses. Kalmia angustifolia, Rhododendron canadense and Ledum groenlandicum are present but never dominant.

This forest type is very common on poorly drained flats in the vicinity of the Paradise River and its tributaries. On the better drained areas the type changes to black spruce-balsam fir feathermoss type, while on poor areas the black spruce Ledum type is found which grades into the open bog. While not a highly productive site, this type can still produce good pulpwood. The stand table shows more than 1,500 stems per acre, mostly below merchantable sizes.

TABLE V. STAND TABLE, NUMBER OF TREES PER ACRE BY SPECIES AND THREE-INCH DIAMETER CLASSES.

Diameter Class in Inches	Black Spruce	Balsam Fir	Total
1 - 3	645	407	1,052
4 - 6	144	264	408
7 - 9	14	98	112
10 +	..	7	7
Total	803	776	1,579

The area has an average volume of 14.8 cords per acre and a gross annual increment of 27.5 cubic feet.

Area C

Type: Spruce-Birch/Cornus, Fire

Site Class: I

Age-class: 90 years

This area is located in a U-shaped valley approximately a half mile inland from the eastern shore of Paradise River and one mile east of the valley of Paradise. The sample area is surrounded on all sides but the west by a ridge of bedrock which extends to a height of 250 feet above sea level; it has a general five percent slope with a southwest aspect. The soil is a coarse sandy glacial till. Large boulders and stones are present both on the surface and throughout the soil.

A representative soil profile is as follows:

Horizon	Thickness in Inches	Description
A_0	4	Black, partially decomposed organic material.
A_2	6	Grey silty sand.
B_2	24+	Dark reddish brown, sand and glacial till.

The area supports a 90-year-old fire type stand of black spruce with scattered fir and birch. The average merchantable diameter is about seven inches and the average height approximately 40 feet.

Reproduction is adequate but not as abundant as in most forest types (TABLE 6). This appears to be typical of fire-type stands where reproduction from layering is at a minimum.

TABLE VI. REPRODUCTION IN PERCENT STOCKING OF MILACRE QUADRATS. (Basis - 100 quadrats)

Balsam fir	7
Black spruce	58
Black spruce and balsam fir	9
Unstocked	26
Total	100

The ground cover is composed of a dense mat of Hypnum, Calliergon, and Hylocomium mosses, with scattered Trientalis borealis, Maianthemum canadense, and Linnaea borealis. Cornus canadensis is more prolific than elsewhere and seems to be the characteristic plant. Alnus rugosa and Salix spp. occur in clumps in small stand openings.

This type is found on lower slopes with a rich till soil and a fairly recent fire history. On drier areas it grades into the spruce-fir feathermoss forest and on wet flats it changes to the black spruce Sphagnum forest type. This is an exceptionally good pulpwood producing type which is now at the point of maximum production. The following stand table shows a comparative minor percentage of stems in the unmerchantable classes.

TABLE VII. STAND TABLE, NUMBER OF TREES PER ACRE BY SPECIES AND THREE-INCH DIAMETER CLASSES.

Diameter in Inches	Spruce	Fir	Birch	Total
1 - 3	347	14	12	373
4 - 6	509	10	38	557
7 - 9	219	3	18	240
10 +	22	1	7	30
Total	1,097	28	75	1,200

The sampled area has an average softwood volume of 28.8 cords per acre. The current annual increment is 67 cubic feet while the mean annual increment is 27 cubic feet.

Area D

Type: Black spruce/Lichen, Fire

Site Class: III

Age-class: All-aged

This area is located about one quarter of a mile inland from a point on the south bank of the Paradise River where the river enters First Lake. It is situated on a flat terrace at an elevation of about 100 feet above the lake level.

The soil is a silty sand to loamy sand, very compact and containing numerous rounded stones and boulders of varying sizes. There is a cemented layer about four inches below the surface which, together with the general compaction of the entire profile, seems to prevent root penetration to any great depth.

The following soil profile is representative of the area:

Horizon	Thickness in Inches	Description
A_0	1	Dark brown, undecomposed raw humus.
A_2	3	Ash grey, silty sand.
B_1	2	Red-brown, cemented silty sand.
B_2	9	Light brown, compacted loamy sand.
C	10+	Grey compacted silty sand.

The stand is composed of all-aged black spruce which originated from a fire about 200 years ago. It is typical of the spruce lichen forest in being very open and slow growing. Very few trees exceed eight inches in diameter and 30 feet in height.

Reproduction is abundant. TABLE 8 shows a total of 78 percent stocking. Black spruce reproduces almost entirely from layers whereas all the larch originated from seed.

TABLE VIII. REPRODUCTION IN PERCENT STOCKING OF MILACRE QUADRATS.
(Basis - 100 quadrats)

Balsam fir	1
Black spruce	67
Eastern larch	4
Black spruce and eastern larch	6
Unstocked	22
Total	100

The minor vegetation is characterized by a dense cover of _Cladonia_ spp. which gives the area a snowy appearance especially outstanding on aerial photographs. Other minor vegetation consists of _Empetrum nigrum_, _Vaccinium angustifolium_ and _Ledum groenlandicum_. These species are never dominant and usually form an open stratum above the lichen layer.

The forest type is probably the most common in the lower Paradise watershed. It is found on all low-lying lake terraces and on upland soils with a thin till covering over bedrock. Whereas the lichen forests of the Lake Melville and Sandwich Bay regions are similar in their minor vegetation, landform, and moisture regime, they differ in the texture of their soils. The Lake Melville lichen forests on low-lying terraces are characterized by stone-free, fine sands or silty sands, while silty sands containing numerous stones ranging up to large boulders are more characteristic of the Sandwich Bay area.

This forest type is unproductive. While the present crop may be harvested on certain portions, the land it occupied should be excluded from the productive forest area. TABLE 9 shows 1,183 stems per acre, most of which are below merchantable sizes and which are most unlikely ever to produce merchantable trees.

TABLE IX. STAND TABLE, NUMBER OF TREES PER ACRE BY SPECIES AND THREE-INCH DIAMETER CLASSES.

Diameter Class in Inches	Spruce	Fir	Total
1 - 3	964	12	976
4 - 6	186	1	187
7 - 9	18	-	18
10 +	2	-	2
Total	1,170	13	1,183

The area has a merchantable volume of 3.4 cords and a current annual increment of 5 cubic feet.

Area E

Type: Black spruce/Ledum, Undisturbed
Site Class: III
Age-class: All-aged

Area E is situated approximately 1,000 feet south of Area D. The area is poorly drained depression between a shoreline sand terrace and a low rocky ridge. The soil is a fairly shallow sandy clay overlying bedrock; the mineral soil is overlain by a deep organic muck. Occasional rock outcrops are visible throughout the area. A typical profile is as follows:

Horizon	Thickness in Inches	Description
A_o	24	Black partially decomposed organic material.
G	15	Blue-grey, mottled sandy clay.
D		Bedrock.

The stand is composed of all-aged black spruce with scattered balsam fir and larch. This is an example of one of the poorer forest types which, together with the spruce lichen forest, extends over about 70 percent of the general area. Growth is very slow and although individual trees live for 300 years their diameters seldom exceed nine inches at breast height. Many of the older trees are diseased; there are many dead trees and butt rot is prevalent.

Reproduction (TABLE 10) appears adequate but this is mainly because tree growth is so slow that at 50 years they may still be in the reproduction sizes.

TABLE X. REPRODUCTION IN PERCENT STOCKING OF MILACRE QUADRATS.

Black spruce	46
Balsam fir	6
Larch	8
Spruce and larch	13
Spruce and fir	1
Fir and larch	1
Unstocked	25
Total	100

Heath plants form the characteristic minor vegetation; these plants in order of abundance are *Ledum groenlandicum*, *Chamaedaphne calyculata*, and *Vaccinium myrtilloides*. Herbaceous plants are represented by the moisture preferring *Rubus chamaemorus*, *Equisetum* spp. and *Smilacina trifolia*. The moss layer consists almost entirely of *Sphagnum* spp.

Stands of this nature occur at all elevations where the drainage is impeded. In general they are unproductive but there is a slow gradation from the better drained spruce Sphagnum type down to the open bog. This particular stand is somewhat poorer than the average with most of the trees in the one to three inch diameter class.

TABLE XI. STAND TABLE, NUMBER OF TREES PER ACRE BY SPECIES AND THREE-INCH DIAMETER CLASSES.

Diameter Class in Inches	Black Spruce	Balsam Fir	Eastern Larch	Total
1 - 3	690	73	235	998
4 - 6	191	12	-	203
6 - 9	16	-	-	16
Total	897	85	235	1,217

The area has a merchantable volume of 3.3 cords per acre and a gross current annual increment of 5 cubic feet.

Area F

Type: Black Spruce/Sphagnum, Undisturbed

Site Class: II

Age-class: All-aged

Area F is located about one-half mile inland from the south shore of the head of First Lake where the Paradise River enters the lake. It is situated on the lower portion of a steep slope where the terrain changes to almost flat. The elevation is about 500 feet above sea level. The soil is a coarse gravelly sand over bedrock. The soil profile was shallow owing to the presence of a perched water table. The following description does not show the underlying bedrock but its presence is surmised from the scattered outcrops in the vicinity.

Horizon	Thickness in Inches	Description
A_o	12	Live and decaying peat moss with black mucky humus for the last three inches.
B	8	Sand compacted at the bottom.

The stand is overmature black spruce which appears to have originated from windfall about 250 years ago. It is opening up now through decadence and balsam fir is coming into the openings. The fir are noticeably unhealthy and probably this invasion is only temporary.

Reproduction (TABLE 12) is abundant and well-representative of the good type. Black spruce originates from layering, whereas balsam fir and larch are mainly from seed.

TABLE XII. REPRODUCTION IN PERCENT STOCKING OF MILACRE QUADRATS

Black spruce	31
Balsam fir	24
Eastern larch	1
Spruce and fir	12
Spruce and larch	6
Fir and larch	1
Spruce, fir and larch	1
Unstocked	24
Total	100

The ground vegetation is dominated by *Sphagnum* spp. which form a dense spongy wet moss layer. *Ledum groenlandicum* is prevalent while *Alnus* occurs in all openings throughout the stand.

This forest type is closely related to the spruce Ledum type, the major ecological difference being in the moisture regime. The spruce Sphagnum type although found on wet sites is considerably drier than the spruce Ledum type. In both cases the ground vegetation is similar with the type name signifying the dominant species.

The sampled area, although overmature, is representative of the type which appears to be widespread in the Sandwich Bay region. This is a slow-growing forest which nevertheless produces good pulpwood; it will however require a long rotation. The following table shows a high percentage of balsam fir, but this is thought to be an unstable condition and the type will eventually revert to a pure black spruce stand.

TABLE XIII. STAND TABLE, NUMBER OF TREES PER ACRE BY SPECIES AND THREE-INCH DIAMETER CLASSES.

Diameter Class in Inches	Black Spruce	Balsam Fir	Total
1 - 3	264	298	562
4 - 6	247	89	336
7 - 9	161	10	171
10 +	11	1	12
Total	683	398	1,081

The stand has a merchantable volume of 18.3 cords. This volume has probably been maintained at about the same level for a considerable time despite the obvious decadence and consequent thinning out of the stand. Gross annual increment is 32 cubic feet.

Area G

Type: Fir-Spruce-Birch/Rich Herb, Undisturbed

Site Class: I

Age-class: All-aged

Area G is located near the shoreline of First Lake approximately one quarter of a mile east of the estuary of Sandy Hill Brook. The sampled area is a low, narrow, well-drained terrace extending along the lake shore. The soil is formed from rich alluvial deposits laid down by spring flooding. The water table, encountered at a depth of two feet, fluctuates according to the season.

Horizon	Thickness in Inches	Description
A_0	9	Partially decomposed organic material mixed with fine silts and sands.
A_2	2	Light grey silty sands.
B	16	Brown loamy sand.
C	6+	Blue-grey mottled silt, sand and clay.

The stand is composed of all-aged balsam fir, black spruce and white birch with scattered white spruce. The oldest trees have an age in excess of 200 years and the stand is understocked, which seems to indicate the breaking up of an old even-aged stand. This area is an example of the best forest type and individual trees sometimes grow to remarkable sizes.

Reproduction (TABLE 14) is both luxuriant and abundant with balsam fir being the dominant species.

TABLE XIV. REPRODUCTION IN PERCENT STOCKING OF MILACRE QUADRATS. (Basis - 110 quadrats)

Balsam fir	73
Black spruce	14
Balsam fir and black spruce	9
Unstocked	4
Total	100

Ground cover in this area is very heterogeneous. The herbaceous plants in particular are well represented; some of the more common of these are Maianthemum canadense, Clintonia borealis, Solidago macrophylla, and Moneses uniflora, Streptopus amplexifolium. The mosses are mainly Calliergon, Hypnum, and Hylocomium. Ledum groenlandicum and Vaccinium spp. are usually present but never dominant, while Alnus rugosa occurs in scattered patches. Pteridium aquilinum and Lycopodium spp. are occasionally encountered.

This forest type is not widespread, it is found occasionally along the fringes of lakes and rivers on low terraces where soil and moisture conditions are favourable; it also occurs on the lower portion of steep well-drained till slopes. There is a striking similarity between this type and its counterpart in the Lake Melville area although the Sandwich Bay volumes are usually lower. The volume of this particular stand is lower than the average because of low stocking, as evidenced in the following table.

TABLE XV. STAND TABLE, NUMBER OF TREES PER ACRE BY SPECIES AND THREE-INCH DIAMETER CLASSES.

Diameter Class in Inches	Balsam Fir	Black Spruce	White Spruce	White Birch	Total
1 - 3	404	350	-	7	761
4 - 6	89	218	-	15	338
7 - 9	47	84	-	5	134
10 +	26	33	2	20	75
Total	566	685	2	47	1,308

The stand has a softwood volume of 27.6 cords per acre and a gross annual increment of 67 cubic feet.

Area H

Transition Zone

This area is located approximately one mile from the shoreline of First Lake in the valley of Sandy Hill Brook. It is situated on a lower hillside, with a southwestern exposure and a slope which varies from five to 15 percent. The elevation is only 250 feet above sea level, and consequently the area was inundated by the waters of First Lake after the last glacial period. The soil parent material reflects its lacustrine origin, being composed of mixtures of clay and sand. The following soil profile was taken on the slope at an elevation of 200 feet above sea level.

Horizon	Thickness in Inches	Description
A_o	8	Raw humus.
A_2	4	Light grey, silty sand.
B_2	12	Red-brown, sandy clay loam.
C	25+	Grey homogeneous mixture of clay, sand, and coarser material.

This is an open black spruce stand containing trees of all ages up to 170 years. The area probably regenerated slowly after a fire possibly 180 years ago and, despite the apparently favourable soil and moisture conditions, the growth rate and tree form is poor.

Although the area is classed as undisturbed, the reproduction pattern shows adequate stocking. This is probably because growth is slow and many trees 50 years old are still classed as reproduction. Black spruce is practically all from layering and frequently concentric rings of layers are seen around the mother tree.

TABLE XVI. REPRODUCTION IN PERCENT STOCKING OF MILACRE QUADRATS
(Basis - 100 quadrats)

Black spruce	63
Balsam fir	7
Spruce and fir	10
Unstocked	20
Total	100

Minor vegetation is normally in two strata. The ground is covered with a dense carpet of *Calliergon Schreberi*, *Hypnum* and *Hylocomium* spp., while over this is a less dense but uniform layer of dwarf shrubs consisting of *Vaccinium* spp., *Kalmia angustifolia* and *Ledum groenlandicum*.

This forest type has not been sampled previously although some evidence of its occurring, usually as small patches, was seen in the Lake Melville area. The site is essentially dry, and the forest is possibly a transition between the spruce lichen and spruce-fir feathermoss fire type. With full stocking the cover of dwarf shrubs would disappear and the recognized spruce Calliergon type would evolve. The area may be classed as productive forest although stocking and merchantable volume are low. TABLE 17 shows more than 1,300 stems per acre but the majority of these are unmerchantable.

TABLE XVII. STAND TABLE, NUMBER OF TREES PER ACRE BY SPECIES AND THREE-INCH DIAMETER CLASSES.

Diameter Class in Inches	Black Spruce	Balsam Fir	Total
1 - 3	894	131	1,025
4 - 6	190	39	229
7 - 9	95	4	99
10 +	16	-	16
Total	1,195	174	1,369

The area has a merchantable volume of 12.7 cords and a gross annual increment of 18 cubic feet.

Area I

Type: Black spruce/Lichen, Fire

Site Class: III

Age-class: 50 years

Area I is located about 1,000 feet north of a point on the shore of First Lake where it is entered by the Paradise River. It is situated on a flat to slightly sloping terrace at an elevation of about 70 feet above sea level.

The general landform and the texture of the underlying soil are both indicative of a glacial-fluvial origin. It appears, from the presence of numerous stones and boulders near the surface, that this old river terrace was later capped by glacial till; still later it was covered by a thin deposition of alluvial material.

The following profile is typical:

Horizon	Thickness in Inches	Description
A_0	5	Raw humus.
A_2	2	Light grey silty sand.
B_1	3	Grey-brown fine sand and silt.
B_2	12	Red-brown partially cemented fine sand and silt. Iron stained.
C	15+	Fine to medium grey sand. Stones and boulders throughout.

Area I supports an even-aged 50-year-old fire-type stand. Black spruce is the principal species with scattered balsam fir and larch. Lichen forests at their best are barely productive and young stands of this nature scarcely warrant the name of forests. The stand is understocked and the trees are small although diameter growth can be surprisingly rapid. The largest tree on this area is eight inches in diameter with a height of 25 feet.

Reproduction is inadequate despite the presence of many 50-year-old trees less than one inch in diameter and classed as reproduction. The dense lichen cover probably prevents seed from reaching a favourable seeding media as the present spruce reproduction all come from layering.

TABLE XVIII. REPRODUCTION IN PERCENT STOCKING OF MILACRE QUADRATS.
(Basis - 100 quadrats)

Black spruce	23
Balsam fir	4
Larch	1
Black spruce and balsam fir	5
Unstocked	67
Total	100

Ground vegetation is dominated by *Cladonia* spp.; these form such a dense layer that herbs are completely excluded. Dwarf shrubs such as *Ledum groenlandicum* and *Vaccinium* spp. occur as uniformly scattered specimens, while *Salix* spp. and *Alnus* spp. occasionally occur in small clumps.

The spruce lichen type is widespread in the Sandwich Bay area but the stands are usually older and denser than the present sample and consequently have more volume. On aerial photographs these types appear as white to dark-grey patches depending upon stand density and age. The vegetation of the lichen type is highly combustible and all stands have a fire origin. It is therefore difficult to tell which is cause and which is effect. Despite the rapid growth of merchantable trees these stands never support a high volume. Factors contributing to this are a very slow rate of growth for reproduction, slow height growth, and low density of the stands. The following table shows the influence of these factors.

TABLE XIX. STAND TABLE, NUMBER OF TREES PER ACRE BY SPECIES AND THREE-INCH DIAMETER CLASSES.

Diameter Class in Inches	Spruce	Fir	Larch	Birch	Total
1 - 3	182	83	11	9	285
4 - 6	105	12	3	1	121
7 - 9	5	1	-	1	7
Total	292	96	14	11	413

The area has a merchantable volume of 1.9 cords and a current annual increment of 14 cubic feet.

Area K

Transition Zone

Area K is located one mile northwest of the estuary of the Paradise River; it has a southern exposure and an elevation of 400 feet above sea level.

The soil consists of a fairly shallow sandy loam overlying bedrock. Numerous angular stones of all sizes are scattered over the surface and throughout the soil and in many places bedrock is exposed. The soil varies considerably in depth with an over-all average of two feet; it is usually moist and because of the steep slope there is usually a plentiful supply of seepage water rich in nutrients. The following profile is typical:

Horizon	Thickness in Inches	Description
A_0	4	Partially decomposed organic material.
A_2	3	Grey silty sand.
B_2	6	Red-brown sandy loam.
B_3	8	Grey-brown loamy sand.
D		Bedrock.

The stand is mainly balsam fir with scattered black spruce and white birch. This is an all-aged stand which originated, probably from windfall, about 250 years ago. Growth is moderately good and some trees reach a diameter of 16 inches and a height of 50 feet. There is some evidence of old cutting which may be a contributing cause for the dominance of balsam fir. The stand is fairly open but openings tend to be rapidly filled with reproduction.

Reproduction, mainly balsam fir, is abundant. Many of the stocked quadrats contain more than 10 seedlings and thicket conditions prevail.

TABLE XX. REPRODUCTION IN PERCENT STOCKING OF MILACRE QUADRATS. (Basis - 100 quadrats)

Balsam fir	89
Balsam fir and black spruce	3
White birch	1
Unstocked	7
Total	100

Ground vegetation consists mainly of Calliergon Schreberi and Hypnum spp.; scattered herbs are present such as Cornus canadensis, Maianthemum canadense, Clintonia borealis, and Linnaea borealis; scattered clumps of Alnus rugosa are found in small openings.

This sampling area was not well chosen. It appears to be a transition zone between the spruce-fir Calliergon and the spruce-fir-birch rich herb forest types.

The species composition and minor vegetation approximates the latter type, whereas tree heights and growth rate correspond with the former. The soil and landform could suit either type, but, being an upper slope, it is more likely to fall into the spruce-fir Calliergon category. A further complication is that the limited selection cutting of the past has changed the stand composition and resulted in a great number of young trees (TABLE 21).

TABLE XXI. STAND TABLE, NUMBER OF TREES PER ACRE BY SPECIES AND THREE-INCH DIAMETER CLASSES.

Diameter Class in Inches	Balsam Fir	Black Spruce	White Birch	Total
1 - 3	975	1	3	979
4 - 6	330	7	13	350
6 - 9	131	1	19	151
10 +	47	1	15	63
Total	1,483	10	50	1,543

The present merchantable softwood volume is 21.8 cords per acre. The gross current annual increment is 47 cubic feet.

Area L

Transition Zone

Area L is in the same locality as Area K but is on the reverse side of the ridge with a northern aspect. The slope and elevation above sea level are similar.

In all respects the soil is similar to the previous area and consists of an average two-foot mantle over bedrock. The following profile is normal for the area:

Horizon	Thickness in Inches	Description
A_0	5	Partially decomposed organic matter.
A_2	3	Light grey silty sand.
B_2	6	Red-brown loam.
B_3	8	Grey-brown loamy sand.
D		Bedrock.

The sample area contains an all-aged balsam fir stand with some black spruce and white birch. This stand originated from windfall. Growth is fairly good but not rapid; the maximum diameters are 14 inches and the maximum heights approximately 45 feet.

Regeneration is mainly balsam fir and is similar to the previous area in that it frequently approaches thicket conditions. The scattered black spruce are all from layers.

TABLE XXII. REPRODUCTION IN PERCENT STOCKING OF MILACRE QUADRATS.
(Basis - 100 quadrats)

Balsam fir	79
Black spruce	5
Balsam fir and black spruce	15
Balsam fir and white spruce	1
Unstocked	0
Total	100

The ground vegetation consists of a dense carpet of Calliergon schreberi and Hypnum. Cornus canadensis is a commonly occurring plant, while Clintonia borealis, Trientalis borealis and Solidago macrophylla are occasionally present.

This area is similar to the previous one in being a transition zone. It has characteristics of two types and cannot be properly fitted into either one. The most unusual feature is to find such good forest growing on an upper slope; a favourable aspect does not contribute to productivity as the same forest type was found on reverse slopes. No cutting disturbance was found here but there is approximately the same proportion of young trees (TABLE 23) as was found on the previous area.

TABLE XXIII. STAND TABLE, NUMBER OF TREES PER ACRE BY SPECIES AND THREE-INCH DIAMETER CLASSES.

Diameter Class in Inches	Balsam Fir	Black Spruce	White Birch	Total
1 - 3	486	51	22	559
4 - 6	426	25	162	613
7 - 9	99	50	85	234
10 +	10	14	31	55
Total	1,021	140	300	1,461

The softwood merchantable volume is 20.9 cords. The gross current annual increment is 47 cubic feet.

REFERENCES

1. Christie, A.M. - 1955 - Geology of the Southern Coast of Labrador from Forteau Bay to Cape Porcupine, Newfoundland. Geol. Survey of Canada, 51-13, Dept. Mines and Technical Surveys, Ottawa.

2. Halliday, W.E.D. - 1937 - A Forest Classification for Canada. Canada, Dept. of Resources and Development, Forestry Branch Bulletin 89.

3. Meteorological Division, Dept. of Transport, Canada, 1954. Addendum to Volume 1 of Climatic Summaries for Selected Meteorological Stations in Canada.

Figure 1

Comparison of Number of Trees per Acre
Four Inches & over at Breast Height
by
Forest Types & Localities

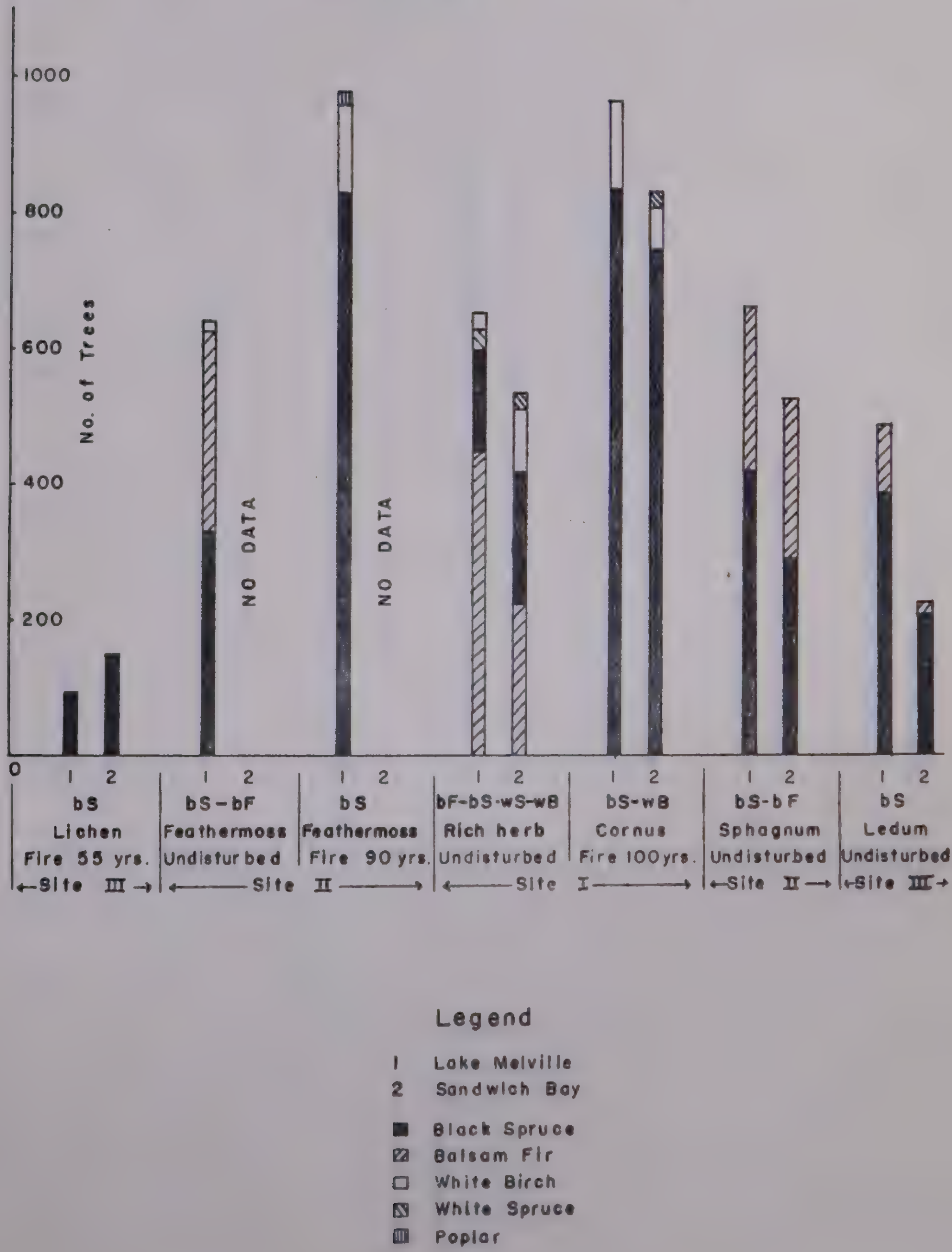


Figure 2

Comparison of Basal Area per Acre

by

Forest Types & Locations

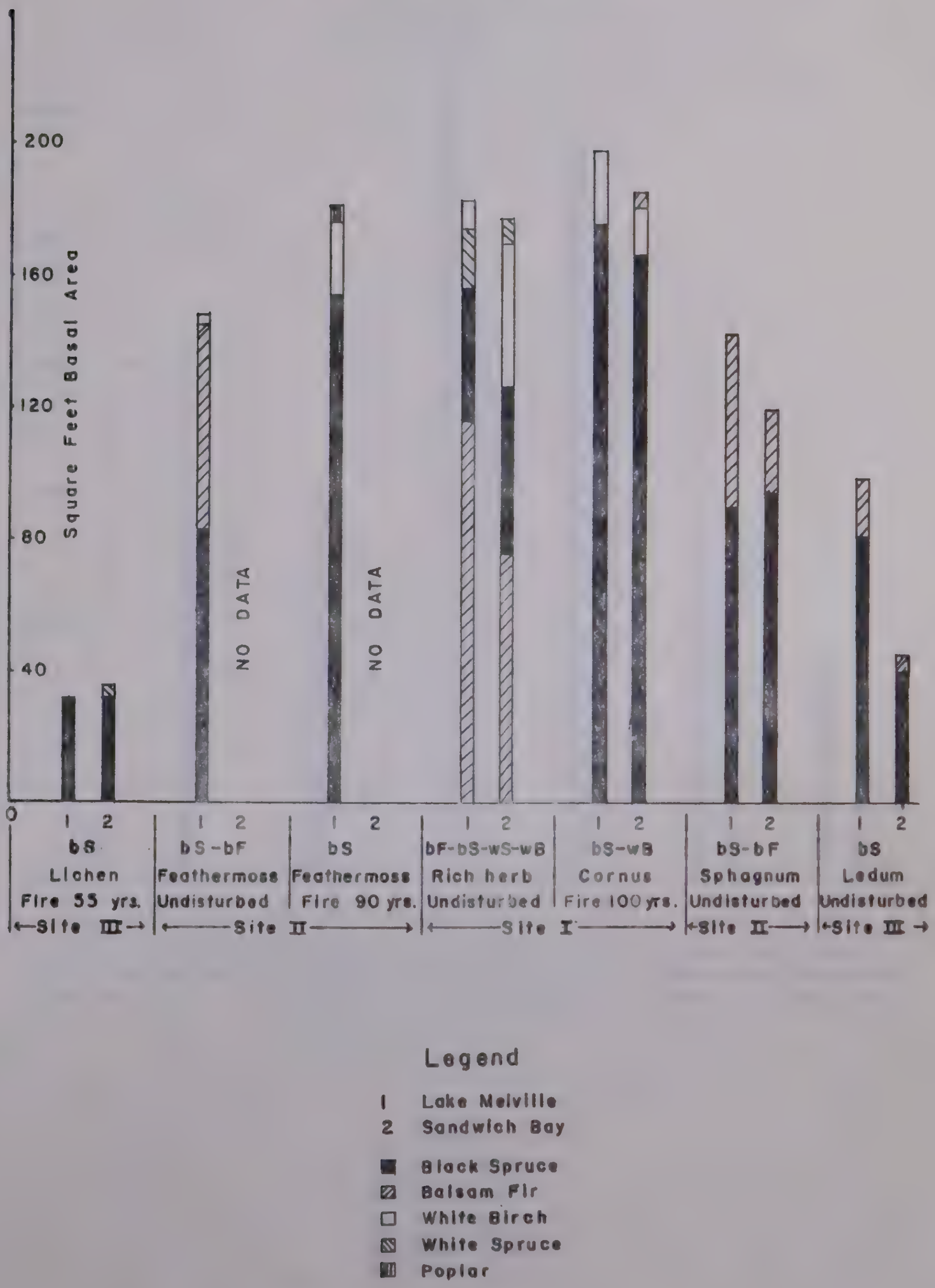
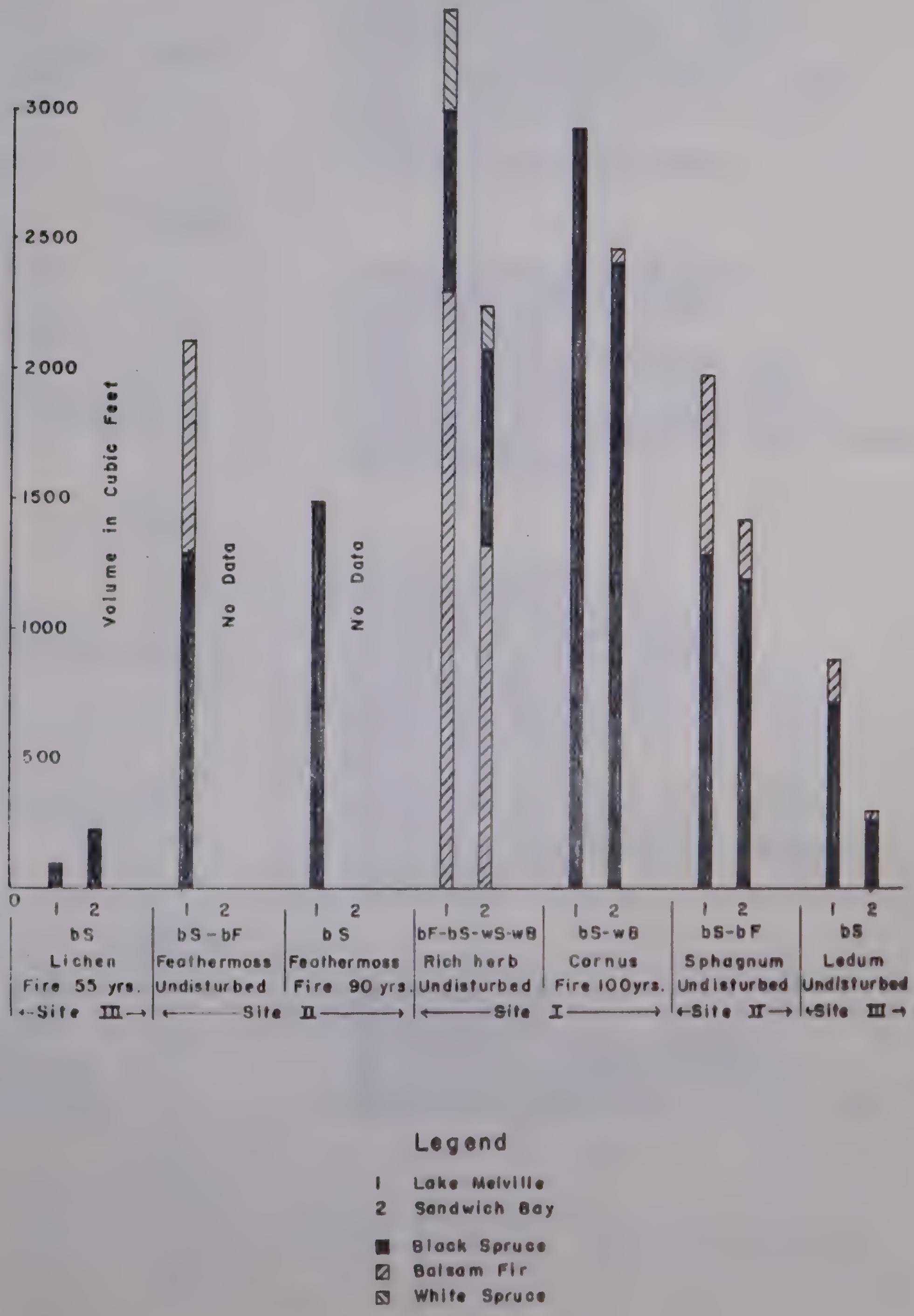


Figure 3

Comparison of Softwood Volume per Acre by Forest Types & Localities



APPENDIX I

LIST OF COMMON AND SCIENTIFIC NAMES OF FOREST FLORA

Common Name	Scientific Name
Trees	
Balsam fir	*Abies balsamea* (L.) Mill
Black spruce	*Picea mariana* (Mill.) BSP.
White spruce	*Picea glauca* (Moench) Voss
Trembling aspen (Poplar)	*Populus tremuloides* Michx.
Eastern larch	*Larix laricina* (Du Roi) K. Koch
Mountain ash	*Pyrus americana* (Marsh.) D.C.
Willow	*Salix* spp.
White birch	*Betula papyrifera* Marsh.
Shrubs	
Labrador tea	*Ledum groenlandicum* Retz.
Blueberry	*Vaccinium angustifolium*
Speckled alder	*Alnus rugosa*
Rhodora	*Rhododendron canadense*
Squashberry	*Viburnum edule* (Michx.) Raf.
Velvet leaf blueberry	*Vaccinium myrtilloides* Michx.
Leatherleaf	*Chamaedaphne calyculata* (L.) Moench
Crowberry	*Empetrum nigrum* L.
Herbs	
Bunchberry	*Cornus canadensis* L.
Twinflower	*Linnaea borealis* L.
Starflower	*Trientalis borealis* Raf.
Wild lily-of-the-valley	*Maianthemum canadense* Raf.
Goldenrod	*Solidago macrophylla* Pursh
Clintonia	*Clintonia borealis* (Ait.) Raf.
Bakeapple	*Rubus chamaemorus* L.
Horsetail	*Equisetum* spp.
False Solomon's Seal	*Smilacina trifolia* (L.) Desf.
Pyrola	*Moneses uniflora* (L.)
Bracken	*Pteridium aquilinum* (L.) Kuhn
Clubmoss	*Lycopodium* spp.
Mosses	
Reindeer moss	*Cladonia* spp.
Sphagnum moss	*Sphagnum* spp.
Hypnum moss	*Hypnum crista-castrensis* L.
Calliergon moss	*Calliergon schreberi* Willd.
Hylocomium moss	*Hylocomium splendens* (Hedw.) Brg. Eur.

APPENDIX II

Supplementary Tables

Table 1. BALSAM FIR
AVERAGE HEIGHT AND MERCHANTABLE VOLUME* PER TREE BY DIAMETER AND SITE CLASSES

Diameter at B.H.	Average Total Height Site Classes			Merchantable Volume Site Classes		
	I	II	III	I	II	III
(Inches)	(Feet)			(Cubic Feet)		
4	27	23	19	0.7	0.6	0.6
5	32	28	23	1.5	1.4	1.2
6	38	33	38	2.9	2.6	2.2
7	43	38	33	4.5	4.0	3.5
8	47	42	37	6.4	5.8	5.2
9	51	46	40	9.2	8.3	7.1
10	55	49	43	12.2	11.0	9.5
11	58	52		15.7	14.2	
12	61	55		19.6	17.9	
13	64	57		23.8	21.4	
14	66	59		28.1	25.9	
15	67	60		32.4	30.2	
16	69			37.5		

*Stump height 1 foot, Top diameter 3 inches, Form class 60

Table 2. BLACK SPRUCE
AVERAGE HEIGHT AND MERCHANTABLE VOLUME* PER TREE BY DIAMETER AND SITE CLASSES

Diameter at B.H.	Average Total Height Site Classes			Merchantable Volume Site Classes		
	I	II	III	I	II	III
(Inches)	(Feet)			(Cubic Feet)		
4	28	26	22	.58	.56	.52
5	35	32	27	1.59	1.48	1.28
6	40	37	32	2.80	2.62	2.30
7	45	41	36	4.47	4.12	3.68
8	49	45	39	6.55	6.03	5.27
9	52	48	41	8.78	8.19	7.11
10	55	50	43	11.5	10.6	9.27
11	57	51	44	14.4	13.0	11.4
12	58	52	17.6	17.6	16.0	
13	59	53		21.3	19.3	
14	60	53		25.0	22.4	
15	61			29.0		
16				33.2		
17				37.5		

*Stump height 1 foot, Top diameter 3 inches, Form class 60

Table 3

DIAMETER GROWTH IN INCHES OF EVEN-AGED BLACK SPRUCE

Diameter in Inches	Site Class I 90 Years	Site Class II 50 Years	Site Class II 100 Years
	10 Year Diameter Increment		
4	0.44	1.02	0.24
5	.50	1.10	.28
6	.54	1.16	.32
7	.58	1.20	.34
8	.61	1.22	.36
9	.65	1.24	.37
10	.66	1.25	
11	.68		
12	.69		
13	.69		
14	.70		
15	.70		

Table 4

DIAMETER GROWTH OF ALL-AGED STANDS

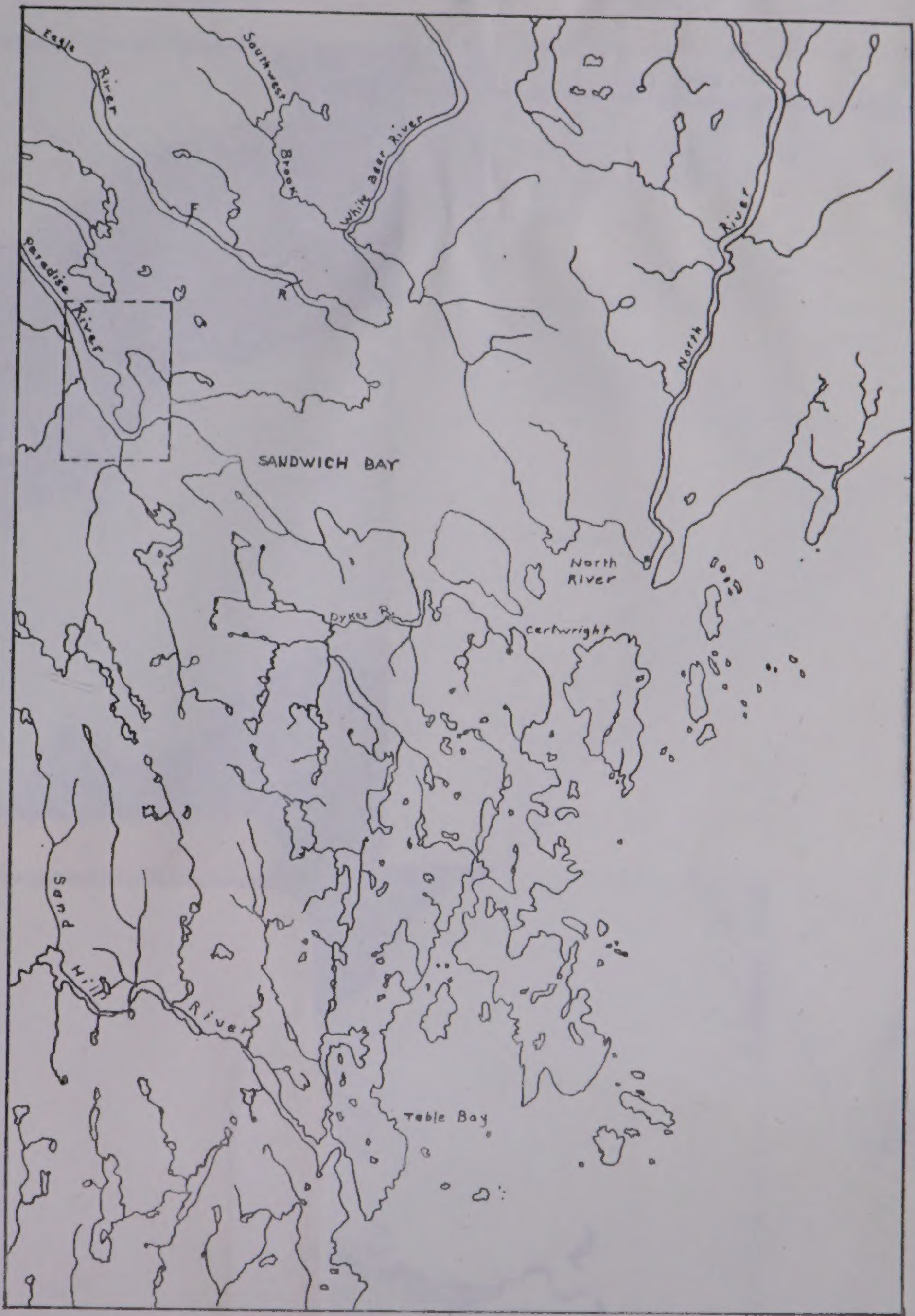
Black Spruce

	Average Diameter* in Inches	10 Year Diameter Growth in Inches
Site I	8.3	0.76
Site II	7.3	.40
Site III	4.6	.25

Balsam Fir

	Average Diameter* in Inches	10 Year Diameter Growth in Inches
Site I	9.2	0.84
Site II	8.2	.68

*A summary of merchantable trees measured for growth data. No trees less than 3.6 inches in diameter at breast height were measured. Average diameters are arithmetic averages.



SANDWICH BAY AREA
of
Eastern Labrador

Showing

Location of Study Area

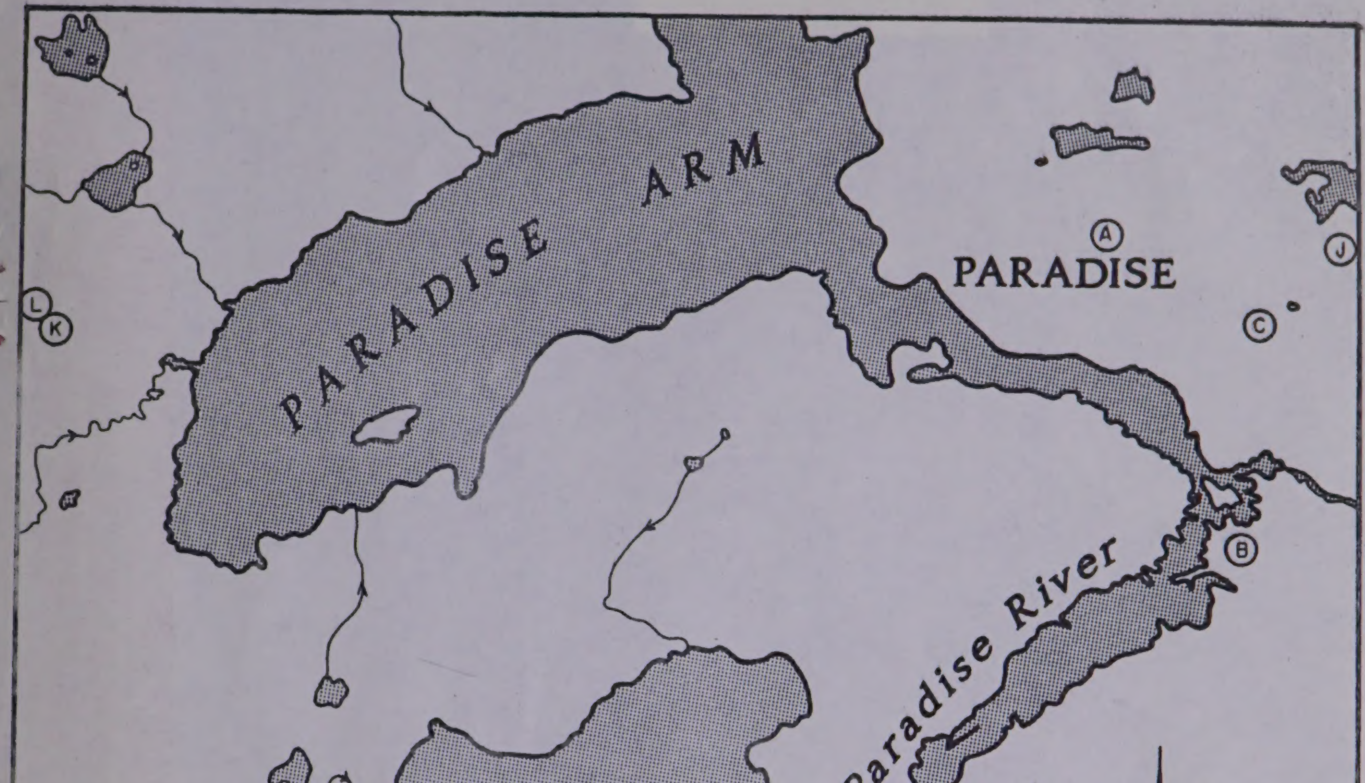
Map Scale: 1" = 8 miles

Date Due

Pam 634.904 : (*423)

Canada. Northern Affairs & National Resources. Forestry Br. Forest Research Div.
The Forests of the Sandwich Bay Area, Labrador. by W.C. Wilton,

Pam 634.904: (*423)



ORIENTATION MAP

LOWER PARADISE RIVER

University of Alberta Library

0 1620 0336 6281